**Response to 2011 Review Panel Recommendations**

In June 2011, the Delta Science Program convened an independent science panel to review the first draft of an adaptive management plan (AMP) for implementing the fall outflow action stipulated in the US Fish and Wildlife Service's Biological Opinion on the long term operations of the Central Valley Project/State Water Project. The 1.5-day review session included presentations from agency staff and opportunities for discussion. The panel delivered a report of its findings and recommendations three weeks later. This much appreciated quick turnaround time made it possible to incorporate many of the comments and recommendations into the planning process for the fall 2011 monitoring and research effort and the revision of the AMP. Below is a summary of how the panel's recommendations were addressed.

**Recommendation 1.** *All parties interested in assessing the effectiveness of proposed actions for DS should engage in the development of the study and monitoring plan for the Fall 2011 action.*

Development of the study and monitoring plan was informed by input from stakeholders at a public workshop in May 2011. From that point on, the process was entirely driven by the Interagency Ecological Program (IEP) owing mostly to the tight time line and the fact that the fall action was still the subject of litigation. It is Reclamation's intent to substantially enhance stakeholder involvement in future AMP development and implementation both in the context of the fall action and more generally as a way to encourage a healthy Delta science culture.

**Recommendation 2.** *An explicit, succinct discussion of constraints on the provision of controls and replication needs to be incorporated into the Plan including an explanation of why controls and spatial replication within a given study year are not possible….In addition, the long-term AM Plan should include some discussion of statistical procedures that can be employed to account for interannual variation in variables that might confound the interpretation of changes in DS abundance.*

The Cache Slough Complex, which includes the Sacramento Deepwater Ship Channel between its confluence with Cache Slough and the port of West Sacramento, in effect serves as a pseudo-control for this pseudo- experiment. This portion of delta smelt habitat experienced the same meteorological conditions prior to and during the outflow treatment, but was not subjected to an increase in inflow. The need for a baseline condition for comparison was met by using monitoring data collected during 2006, the only post-POD wet year on record. Unfortunately, monitoring of the Cache Slough Complex did not start until 2008, so the comparisons between 2006 and 2011 do not include a control.

**Recommendation 3.** *The Fall outflow adaptive management should be formulated as a test case for the draft Delta Stewardship Council guidelines on adaptive management.*

The Council's guidelines on adaptive management were not available when the AMP was in preparation, but the Final Staff Draft of the Delta Plan released May 14, 2012 states that the Council will consider information learned from other adaptive management activities in the Delta when updating the Delta Plan.

**Recommendation 4.** *Attention should be focused in the next few weeks on maximizing the scientific knowledge that can be generated during the 2011 Fall outflow, and in predicting how the X2 standard can be achieved for the minimum loss of storage and depletion of coldwater pools in the large reservoirs.*

Reclamation and the IEP made a concerted effort to maximize the data and information gathered during the fall 2011 outflow period while respecting the need to limit take of delta smelt and other listed fish species. Emphasis was placed on working out the study plan, logistics, methods, etc. rather than on the development of a complete, multi-year AMP.

**Recommendation 5.** *The details of the proposed manipulation and monitoring plan should be made available to the public and interested parties to allow others to contribute to monitoring and studies so as to maximize the capability to address DS and other fundamental questions regarding the functioning of the Delta ecosystem.*

The fall 2011 monitoring and research effort involved all the IEP agencies and about a dozen principal investigators from the University of California-Davis, UC-Berkeley, San Francisco State University and Stanford University. The proposed operations to achieve the Fall X2 target and the monitoring and research plan were incorporated into the revised AMP and posted on the Reclamation and USFWS web sites on August 9, 2011. Preliminary results were presented during a session of the IEP annual workshop in April 2012, attended by some 300 people.

**Recommendation 6.** *The proposed AM Plan should focus on improving the rigor and detail of conceptual models for the DS and other POD-associated species.*

The revised AMP includes the original conceptual model for the Pelagic Organism Decline, a species-specific conceptual model for delta smelt, a description of the 'regime shift' model (an outgrowth of the POD investigations), an estuarine habitat conceptual model originally presented to the State Water Resources Control Board by the 'Environmental Flows Group' and a spatially explicit delta smelt conceptual model for the western Delta and Suisun Bay emphasizing the interaction of stationary and dynamic habitat features hypothesized to drive delta smelt responses. Only the spatially explicit model was used to make predictions, however. Reclamation agrees with the Panel's suggestion that 'where possible, processes and linkages within conceptual models should be "disaggregated" to allow identification of the most proximal factors that work in concert to drive target response variables…'

**Recommendation 7.** *The revised AM Plan should include descriptions of planned methodologies for estimating vital rates, e.g., growth and fecundity of DS, as response variables.*

Methods for estimating vital rates and fish health are provided in the study plans implemented in fall 2011. These plans will be added as an appendix to the next version of the AMP.

**Recommendation 8.** *Reclamation should clearly articulate a conceptual model that explains the expected beneficial effect of the Fall outflow manipulation on DS that includes cause-effect relationships rather than biogeophysical correlations. The proposed conceptual model will be the primary driver of the scientific questions to be addressed in the AM Plan.*

Table 1 in the revised AMP (page 56) provides predictions about qualitative and quantitative outcomes of the fall action. Comparing these predictions to observed responses provided the framework for organizing the draft synthesis report.

**Recommendation 9.** *Reclamation, the Service and other agencies should work to support the development and testing of the proposed Life-Cycle Model (Newman et al.).*

The Newman et al. life cycle model for delta smelt is fully funded and continues to be a high priority work element. Further, the IEP's Management Analysis and Synthesis Team (MAST) is investigating the use of existing peer-reviewed delta smelt modeling frameworks, such as the one recently published by Deriso and Maunder, as platforms for testing key parameters not already modeled.

**Recommendation 10.** T*he Fall outflow provides an opportunity to assess different approaches of achieving X2 and to test the accuracy of the model for management decisions regarding the placement of Fall X2. The magnitude of variation from normal and low flow years (for which much of the detailed monitoring data is already available) will provide a validation that greatly extends the understanding of the Delta ecosystem.*

Flood control requirements limited Reclamation's ability to experiment with different ways to achieve the Fall X2 target. The prescribed X2 was effectively met as a result of reservoir releases.

**Recommendation 11.** *The Panel recommends that efforts are made to standardize the model version, bathymetric grids and boundary forcing used by all parties investigating Fall outflow scenarios with the UNTRIM model (or other hydrodynamic models). This will ensure the discussion focuses on actions and outcomes rather than the specifics of the model setup.*

There was only one party using the UnTRIM model to support the fall X2 study and its principle contribution to date has been to provide estimates of the areal extent of the low salinity zone as a function of X2. This relationship is such a straightforward consequence of geography that specifics of the model setup are not likely to derail discussions focused on actions and outcomes. Field data collected by the Stanford-UC Berkeley team will provide a detailed synoptic description of the tidal flow and salinity fields in Suisun Bay during Nov-Dec 2011 and the same instrument array will be deployed in 2012. These data would provide an additional opportunity to validate the UnTRIM model. Reclamation agrees that linking UnTRIM with SEDIMORPH will provide a badly needed tool for modeling sediment dynamics in the system, but this coupled model is not yet operational. The UnTRIM model is proprietary, so the model, boundary forcing conditions, the bathymetric grid, calibration files and other details will probably not be open and available to other parties. A non-proprietary 3-d model, SUNTANS, is under development, but not slated for release for at least a year, more likely two.

**Recommendation 12.** *The panel strongly urges Reclamation and other agencies to formulate an explicit work plan capable of evaluating changes in the health and condition of DS in response to the X2 manipulation.*

The AMP science plan includes descriptions of study elements focused on evaluating changes in growth rate, health and condition (see pages 86-87). These studies were designed to: (i) detect differences in physiological and morphological health of fish based on body condition factor and organo-somatic indices (e.g., hepato-somatic index); (ii) employ biomarkers capable of selectively recognizing specific types of contaminants (e.g., cytochrome P450 induction from polychlorinated biphenyl (PCB) exposure, vitellogenin or choriogenin induction in males from endocrine disruptor exposure) and biomarkers specific for both exposure and deleterious effects (e.g., endocrine disruption and histopathology); (iii) identify the presence and severity of pathogens/disease as a significant health indicator and relate to stressors and environmental variables; (iv) determine the nutritional status of fish through measures of

body condition, liver to body weight ratio, and total lipid content; (v) relate measures of recent growth (otolith daily increments and ribonucleic acid/deoxyribonucleic acid (RNAIDNA) ratio) to nutritional status, rearing region, and stressors; and (vi) relate size of delta smelt at maturity as well as fecundity and any evidence of repeat spawning obtained from examination of individuals collected in winter and spring collected individuals, to fall growth (otolith increment) and fall rearing region (otolith chemistry contrast: Low Salinity Zone vs Cache Slough regions).

**Recommendation 13.** *Parameters that measure the condition of predator and prey species should be targeted by 2011 monitoring and special studies.*

Reclamation recognizes the potential importance of predation, competition, food supply and other biotic components of smelt habitat as factors that could confound any relationship between fall outflow and delta smelt growth and survival, but did not have the resources to pull a meaningful effort together in time for the 2011 field season. Quantifying predation rates on delta smelt is a difficult technical problem that remains unsolved.

**Recommendation 14.** *The Plan should incorporate monitoring of response variables in DS that have a clear demographic link to DS both at the individual and population level (otolith inferred growth rates, fecundity, condition factor).*

Otolith-inferred growth rates, fecundity and condition factor and other response variables with clear demographic links to delta smelt at the individual and population level were incorporated into the study plan. Some of these results will be presented when the Panel meets on July 31, 2012.

**Recommendation 15.** *Reclamation must show how the proposed monitoring and assessment program will evaluate change from historical data and ongoing monitoring programs.*

The same monitoring and assessment program will continue at least through fall 2012. Comparisons are also being made between data for 2005-2006 (the last post-POD wet year) and 2010-2011, as described in the synthesis report.

**Recommendation 16.** *The Fall outflow plan leadership team should include one individual who is given the freedom to ensure that the implementation and monitoring of the plan is her/his top priority and principal responsibility for the next year starting July 1, 2011. The Panel urges leadership at Reclamation and other invested agencies to be responsive to requests for resources, especially time commitments from the agencies most qualified scientists and managers.*

No individual with the requisite combination of skills and experience could be found to take on this leadership responsibility. Instead, the effort was directed by a sub-committee of the IEP management team that included the IEP lead scientist and technical representatives from Reclamation, FWS, EPA and other IEP agencies.

**Recommendation 17.** *When finalizing the plan, the authors should incorporate lessons from other large-scale ecosystem restoration or AM plans that have been implemented in other litigious and high-stake environments.*

The current draft of the AMP does not include a section on lessons learned from large-scale actions in other systems. Once all the results are in for the 2011 study, it will be possible to make meaningful

comparisons with the successes and failures experienced elsewhere and these results will be included in subsequent drafts of the AMP.